Decision-Support Software for Land Use and Conservation Planning

User's Manual

from

Vista On-line Help

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SECTION ONE

About This Help

This help was created by NatureServe (www.natureserve.org) to accompany its Vista decision-support software for land use and conservation planning.

Additional information related to basic mapping functions utilized in conjunction with Vista can be found in help documentation for the specific Environmental Systems Research Institute (ESRI) (www.esri.com) application being used to develop and manage geographic information system (GIS) layers (e.g., ArcGIS 10). Answers to commonly asked questions and other tips on using Vista may be found in the Knowledge Base on NatureServe's online support site at http://support.natureserve.org/Vista/.

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NatureServe Vista version 2.6

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PREFACE

NatureServe has thirty years of experience collecting and managing biodiversity data through its network of more than 75 state, provincial, and national member Natural Heritage Programs and Conservation Data Centers. We share a common interest with many other organizations in protecting our precious natural heritage and improving our quality of life. As a primary source of biodiversity data across North America, as well as much of Latin America and the Caribbean, the NatureServe network is often the conduit to successful conservation planning efforts. As practitioners, we are challenged by a conservation planning science that is complex and not always integrated with other decision processes. With this in mind, NatureServe Vista was created to provide conservation planning tools to those who are making decisions about our natural resources.

NatureServe Vista was developed by a team of expert conservation planners and software engineers. Our work was primarily funded by a cornerstone grant from the Doris Duke Charitable Foundation and was guided by a panel of expert advisors from all relevant disciplines. The result is a product that we believe has the capability to inform policy decisions and help create outcomes of real conservation significance. As you use this tool, please provide us with regular feedback. Our pledge to you is to support your conservation planning efforts and to continue improving NatureServe Vista in order to provide you with the highest quality conservation planning software available.

ACKNOWLEDGEMENTS

NatureServe gratefully acknowledges the funders, partners, and project team members who helped create the conservation planning methodology and Vista decision support software.

Funders

Providing commercial-quality tools to all those making decisions that affect biodiversity was a tall order and risky venture. We thank our funders for their vision, faith, and willingness to take the risk for biodiversity.

The Doris Duke Charitable Foundation

The NASA ReASON Program

The Surdna Foundation

The Nature Conservancy

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MARXAN Conservation Solution Software

Ball, I. R. and H. P. Possingham, (2000) MARXAN (V1.8.2): Marine Reserve Design Using Spatially Explicit Annealing, a Manual.

Possingham, H. P., I. R. Ball and S. Andelman (2000) Mathematical methods for identifying representative reserve networks. In: S. Ferson and M. Burgman (eds) Quantitative methods for conservation biology. Springer-Verlag, New York, pp. 291-305.

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Data Credit

The biodiversity data shown in illustrations of Vista windows and reports derive from a pilot project carried out with the Land Trust of Napa County, California, which used the following sources for data developed and used in project analyses.

Element data:

California Native Plant Society

California Natural Diversity Database (CNDDB), of the California Department of Fish and Game, Wildlife and Habitat Data Analysis Branch

University of California at Davis, Information Center for the Environment (ICE)

Land status data:

Bureau of Land Management (BLM)

California Spatial Information Library:

http://gio.resources.ca.gov/ "GAP - Managed Areas"

Napa County Agricultural Preserve

Napa County GIS website: http://gis.napa.ca.gov

Napa County website providing information on Title 18 Zoning:

http://www.co.napa.ca.us/code2000/_DATA/TITLE18/index.html

U.S. Geological Survey California GAP program: http://www.biogeog.ucsb.edu/projects/gap/gap_home.html

Public lands data:

Primary Source - GreenInfo Network

Conservation Biology Institute (CBI) Protected Areas Database: http://www.consbio.org

Vegetation cover data:

California Department of Conservation, Division of Land Resource Protection, Farmland Mapping and Monitoring Program

California Department of Conservation, Office of Mine Reclamation, Abandoned Mined Lands Unit: http://www.consrv.ca.gov

California Department of Forestry and Fire Protection

Counties of Colusa, Glenn, Lake, Marin, Soloano, Sonoma, and Yolo, California

National Water Resources Council

U.S. Fish and Wildlife Service

U.S. Forest Service

U.S. Geological Survey

We gratefully acknowledge these sources for providing data, and for allowing their continued use in the graphics included in this documentation. Further, we gratefully acknowledge CNDDB, a NatureServe Natural Heritage member program, for allowing use of their data on significant natural communities and species as a sample data set provided with the software; the use of these data is subject to the provisions and limitations of the Data Sharing Agreement between NatureServe and CNDDB. For further information about CNDDB, visit http://www.dfg.ca.gov/whdab/html/cnddb.html.

Requirements

System Requirements

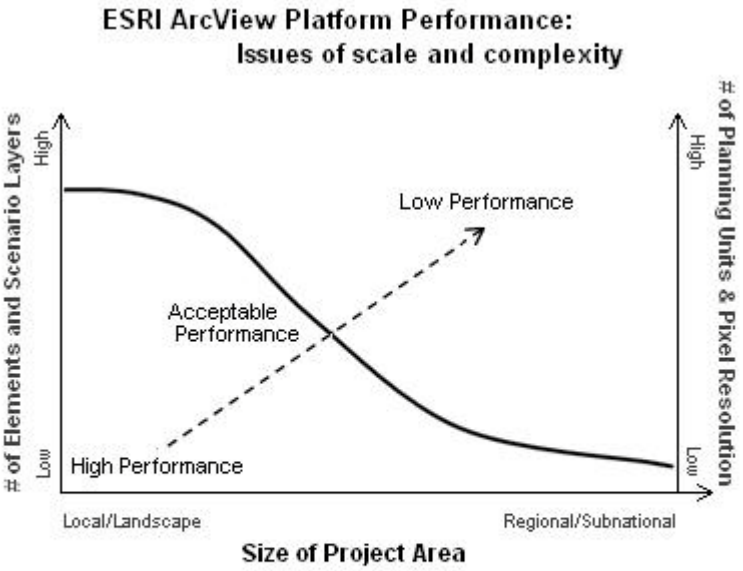
Please see the current requirements in the readme file included with the program or found on our website at: http://www.natureserve.org/prodServices/vista/vista_sys_reqs.jsp

Common Project Requirements

Introduction

Now that you plan to use NatureServe Vista as one of your project tools, you will need to learn how to integrate it into your project or routine planning and assessment activities. However, since Vista has a broad range of applications and can be used by many types of users, we cannot provide prescriptive directions for carrying out every possible project. Instead, we describe a sample of typical planning situations, how Vista and planning methodology can be applied to those problems, types of inputs required, and nature of expertise required. The objective is to help users rapidly initiate projects that will lead directly to the answers required for decision-making. Before you do anything, carefully assess whether Vista, as an ArcView (versus ArcInfo) based tool is able to meet the computational demands of your project. We provide more detailed guidance below but generally the most advanced analyses in Vista cannot process a combination of layers that exceed 1 billion pixels. That means that for projects exceeding approximately 1 million hectares (2.2 million acres) you may need to trade off among the following variables:

- Project extent: if you desire to retain a large project extent (>1 million ha/2.2 million ac) you may need to reduce the number of conservation elements (e.g., by clustering into guilds of elements represented by a single map per guild) and increase the pixel size substantially in your analyses. Keep in mind that if you need to reduce your project extent, you will need to do this before you begin your project because Vista/ArcView will allow you to make project extents larger but not smaller. If in doubt, we recommend starting with a subregion, confirm that Vista can operate satisfactorily, and then enlarge your project accordingly.
- Number of conservation elements: if you desire to have many dozens to hundreds of elements you may need to reduce your project extent (perhaps by breaking your planning region into multiple subregions with separate Vista projects) and or increasing your analytical pixel size.
- Spatial resolution: if you desire to work at fine spatial precision (relative to the size of the planning region e.g., 30 meter to 1 ha) then you may need to reduce project extent and or reduce number of conservation elements.
- Planning sites: if you desire to work with tens of thousands of planning sites you may need to reduce the combination of variables above.



If (# of cells in project area * # of elements * # of planning units) is > 1 billion, then performance limitations will exist. *

* Highly complex datasets may create greater limitations.

Data Collection

Most projects begin with collecting information. Specific information required for initiating a Vista project is described in the Information Needed for Database Construction section. In addition to geographic information system (GIS) data layers such information must also include the values of project stakeholders. Dealing with appropriate data collection and appropriate inclusion of stakeholder values is the most critical piece of all planning projects with or without Vista. For data, you must ensure that data precision and quality match the planning purposes. For stakeholder values, Vista allows different group values to be expressed in several ways such as varying which conservation elements are selected, how their importance is weighted relative to other elements, what conservation goals are assigned to the elements, and which land-use policies are deemed valid. While Vista allows recording and analyses of different sets of values, it is up to the participants to resolve differences in the outcomes these would generate e.g., whether a scenario evaluation that meets a set of low conservation goals is appropriate to implement.

Data input

All projects will require that data be assembled, formatted, and entered into Vista following the simple Vista data model as described throughout this documentation. The basic types of inputs for Vista include:

- Planning region reference information (boundaries, streams, roads, place names, topography, digital orthophotos, etc.)
- Element distribution maps (NatureServe Heritage network element occurrences, Fish and Game species habitat maps, vegetation cover maps, modeled distribution maps, scenic views, historic sites, etc.)
- Element occurrence attributes (viability, integrity, confidence)
- Element information (name, weight, goal, conservation unit, minimum required area, etc.)
- Existing land use map
- Current land use and management policy maps (zoning, public land management plans, etc).

A more complete summary of the information inputs are described in the Data Inputs and Outputs section, but it should be noted that inputs will vary considerably depending on the project objectives, local environment, etc.

Properly assembling the data usually requires ecological and GIS expertise. While obtaining suitable data and getting it into the system is typically the most time-consuming and resource-intensive part of any project, the same is true for all projects utilizing GIS tools. Vista does provide utilities not typically included in most tools to facilitate collecting information, inputting and documenting data, and conducting thorough data validation functions that run in the background.

Common processes

In the examples that follow, the assumption is that the following steps have already been completed:

- Select a database development team
- Identify the conservation elements of interest in the planning region (e.g., species, ecosystems, scenic viewsheds, etc.)
- Develop the database and import all information into Vista
- Establish expert and stakeholder values for element weights and goals

Required Expertise and Information

Data Development Team Composition

A variety of skills will be needed if the goal is biodiversity conservation. Individuals may possess more than one skill, so the following list should not be interpreted as representing the number of team members required. Needed skills also depend on the analyses to be performed.

- Project coordination and management
- Geographic information services
- Data management
- Metadata documentation
- Terrestrial ecology
- Terrestrial zoology
- Aquatic ecology
- Aquatic zoology
- Non-biological domain expertise (depends on elements of interest to the analytical user, e.g., farmland conservation, archaeological sites, etc.)

Information Required Prior to Database Construction

This section describes the information that the analytical user should provide before the data development team begins work on the conservation database. How Vista will be used can have a great influence on the type of data required, and tailoring the database to user needs will save time and money. However, the user should also try to consider longer-term needs to reduce callbacks for additional information. For example, the analytical user may initially request a database of only legally protected elements, then later discover that the community desires much broader wildlife conservation. Even if the data development team and analytical user work on the same project or in the same organization, they should verify that they all agree on the database requirements. The following are some general questions; a check-off list of more specific information requirements is found in the Information Needed for Database Construction section.

- What will be the primary use of Vista – scenario evaluation, investigation, and education; conservation plan development; integration with general land use planning; resource management, etc.?
- Who will be using Vista and what is their level of knowledge and comfort working with the particular problem, data, and complex software?

Information Needed for Database Construction

The process of beginning a Vista project can be facilitated by identifying the various types of information needed to construct the project database first.

Planning region boundary

Identify the data layer that spatially defines the planning region based on whether:

- It is bounded by a single polygon such as a county, state, ecoregion, or watershed.
- It is bounded by specific tracts of land over which the analytical user has planning authority. These tracts may be disjunct and fall within a larger planning region with the intervening tracts left blank as "no data" regions.
- It is bounded by multiple jurisdictions that will cooperate in the implementation of Vista.

Conservation elements.

Identify the specific elements or categories of elements the client wishes to incorporate after reviewing the Vista default list of biodiversity elements and the types of compatible cultural elements that can incorporated. Decide how weights and goals will be assigned.

Baseline scenario composition.

Identify the planning, management, and regulatory jurisdictions operating within the planning region. List them in order them based on the policy dominance in cases when jurisdictional authority overlaps for the same areas.

Analytical services.

Identify any analytical services (e.g., conservation value summaries, baseline scenario evaluation, scenario generation) that the database development team should conduct prior to database delivery.

Post-delivery services.

Identify any planned post-delivery services for the database development team (e.g., review of analytical results).

Delivery date and budget for database and services.

Identify the desired delivery date and budget for delivery of the database including any analytical services.

Data layers and sources.

Identify any the key data layers and sources known to the analytical user that may be unknown to the data development team.

Data Inputs and Outputs

Introduction

Geographic information system (GIS) layers form the backbone of the Vista database, but additional non-spatial information is also required, including weights indicating social values and goals for element conservation. For use of all Vista functions, an extensive amount of data may be needed. The scale of the data and attribute detail will determine the types of analyses that can be done and the precision of the results. Obtaining and formatting the data for Vista can be a significant task and the most expensive part of the project for several reasons:

- Little-to-no data are developed specifically for conservation planning and must be converted for this use.
- Data come from many different sources and disciplines with different standards for projection, attribution, and documentation.
- Data for any planning region are largely incomplete, at different scales, and of different ages.

The following section is intended to provide a synopsis of the required inputs and outputs of Vista. It is not exhaustive but can serve as a guide for planning and getting started on data and expert knowledge acquisition.

Topics in this document are generally arranged in chronological order, although there is a lot of flexibility available after the Base Data and Conservation Element Data are entered.

Pre-processing for all data

All projections and coordinate systems must be identical, clipped to a manageable size that is larger (preferred but not critical) than the project boundary, ESRI-compatible formats.

INPUTS

Base Data

Project Area

Project boundary file must be a single polygon shapefile

- Typically a political or geophysical boundary like a county or watershed is used
- Add this layer to you ArcMap view before doing anything Vista related. This will set you Data Frame properties to match those of the boundary file.

Data Frame

Set to Layers (this will pull projection information from layers already in the .mxd)

- If you have added your pre-processed boundary file to the view, your Data Frame properties will be correct

Cell Size

A default cell size to be used in the project (can be changed at any time)

Snap Raster

ESRI GRID with cell size evenly divisible by the project cell size

Site layer

Any polygon map e.g., parcels, watersheds, etc., typically used for planning or management decisions at the scale of the project.

- This layer should be selected at the onset of the project, but will not be used until more advanced analyses are built

Land use intent list

A hierarchical list modified from the Vista default which describes physical activity/phenomena.

This list will not actually be used until the (Scenario Data section below, however, if you know that you will be creating Scenarios (most likely) then developing and inputting this list now will save a great deal of time because if it is changed, the element response (see below) must be updated by experts.

Conservation Element Data

Spatial distribution

All conservation elements (EOs, modeled habitat, ecosys, historical sites, etc) – polygon preferably defined as occurrences (can be multiple patches associated with a single ID).

- Common sources include NatureServe member network programs for EO data, land cover rasters (must be dissolved and polygonized), BLM, Fish and Wildlife, and in-house habitat and suitability modeling. The Sources of Element Distribution Data section provides information on where these data may be obtained.

Quality scores

Must have Quality scores stored in polygon attribute table or in float raster. Scores must range from 0.0 – 1.0 values (1.0 is high quality). Vista will import and transform Element Occurrence Ranks directly from NatureServe Member Network Program databases using the Biotics data management system.

- Attributes are typically used for occurrence data, while ecosystems, land cover types and some modeled data typically use a 'Landscape Integrity Raster.' The analysis takes into account negative impacts (point-source pollution, roads, mines, runoff, etc) and runs a weighted straight-line distance, then sums the layers.

Confidence scores

Must also have Confidence scores in same format, or in single value entered into text field.

- Heritage data comes with data confidence data and other datasets can be evaluated by expert opinion. These scores slide on a 0.00 – 1.0 relative scale (1.0 is high confidence).

Quantitative goal

Integer of quantity (e.g., 30 acres, 20 occurrences) or percent 0-100 of area or occurrences.

- Goal sets are a scientific value that should describe the minimum amount of an element needed to allow that element to survive/continue to be viable
- Many goal sets are possible. Sometimes when scientific minimums are uncertain a 'High Risk of Losing Element' and a 'Low Risk of Losing Element' goal sets can be made.

Optional minimum viable occurrence size

Integer value of spatial unit (e.g., 100 acres). Note that this applies to an occurrence not a patch so Vista is not very sensitive currently to fragmentation as long as parts of original occurrences sum to MVO. Recommend secondary analyses with fragmentation tools (e.g., HPP, Fragstats) when details about fragmentation relative to minimum viable patch size are important.

Optional categories of membership

Some default categories provided (e.g., ESA rank) but user can create any desired

- Categories help by organizing goals, weights, results reports, etc.

Optional importance weight

Must be a 0.0-1.0 score but many weight lists possible

- Weights should reflect stakeholder values, wishes

Scenario Data

Land use intent list

This is the *same list* that was referenced in the Land use intent list (above). It is included here because this is the last opportunity you will have to modify this list before using it in a scenario. Hopefully modifications are not necessary, because they will require manual updating of each conservation element.

Policy type list (optional but preferred)

A list of policy types (e.g., "zoning regulation") Modification of Vista default list. Can be readily changed any time (in scenario evaluation user must specify reliable policies).

Land use spatial distribution data

Polygon or integer raster map(s) of current, proposed, or modeled land use intents.

- Usually two or three scenarios will be created. This first shows land use as it currently exists. The second or third show possible future uses based and various growth or development predictions (ie CommunityViz models).
- Current land use data can often be obtained from county or city governments

Policy types spatial distribution data

Polygon or integer raster map(s) of current, proposed, modeled policy types usually inferred from the land use input file.

- This is sometimes the land use file, just translated (displayed) using different attributes.

Element responses to land use intents

Options (all sources are from element experts directly or from literature):

Categorical response

Default is selection of "negative, neutral, or beneficial" response. User can add or delete these responses.

- When you set up your responses you are simply designating how the element will be impacted by a particular land use (kind of like saying 'a lot, a little, not at all'). You will determine if the element can persist through that type of impact later.

Landscape condition response

A condition model for one or a group of elements: the degree of impact on persistence from any land use type on the immediate site and a distance effect in 0.0-1.0 scores. Actual spatial condition map is then automatically built when a scenario is entered and a condition evaluation is requested.

OUTPUTS

Elements

(used for basic understanding of element distribution, requirements, areas of high to low value)

Element conservation value

A floating point raster map with cell values reflecting the combined quality and confidence scores. Defines occurrences falling below minimum viable size.

HTML report summarizing element properties and value map

Conservation Value Summary

(used for generally planning to avoid conflicts with high value areas)

Raster floating point map based on several user-defined parameters indicating relatively low to high value of landscape based on element richness and characteristics.

Scenario

Raster integer map of land use intent distribution

Raster integer map of policy type distribution

HTML scenario report

Acreage of combinations of land use intent and policy types and maps of land use intent and policy type.

Scenario Evaluation

(primary output to identify elements not meeting goals, gap in goal achievement, and where conflicts are occurring and of what type)

Compatibility Conflict map

Raster map shows areas where elements do not meet conservation goals and are in conflict with scenario's land use intent. Visualizes "intensity" of conflict via count of number of elements in conflict per pixel.

Policy Conflict map

Raster map shows areas where elements not meeting goals because of unreliable policy and intensity of conflict per above.

Scenario Evaluation Report

HTML format report with tabular results of element goal achievement based on the evaluated scenario.

Site Explorer

(explore conflict issues at particular sites and use to generate alternative scenarios)

Site Selection Report – Conservation Value Summary exploration

HTML format report that indicates the conservation value of the selected site(s) and element information, including the number and percentage of viable occurrences on the site(s).

Site Selection Report – Scenario Evaluation exploration

HTML format report of land use on the selected site(s), along with element inventory and element response to land uses.

- **Optional:** Can be used to specify alternate land use intent and policy type per site (homogenous over entire site). Generates a shapefile that can be integrated in a new Vista alternative scenario.